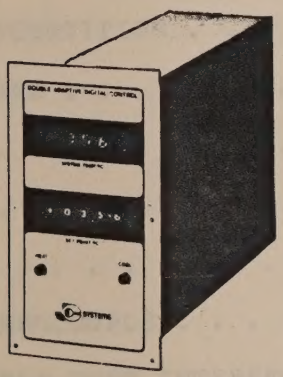
INSTRUCTION MANUAL

MODEL C81210

TEMPERATURE CONTROLLER



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JC SYSTEMS MODEL 210 DIGITAL PROCESS CONTROLLER

1. INTRODUCTION

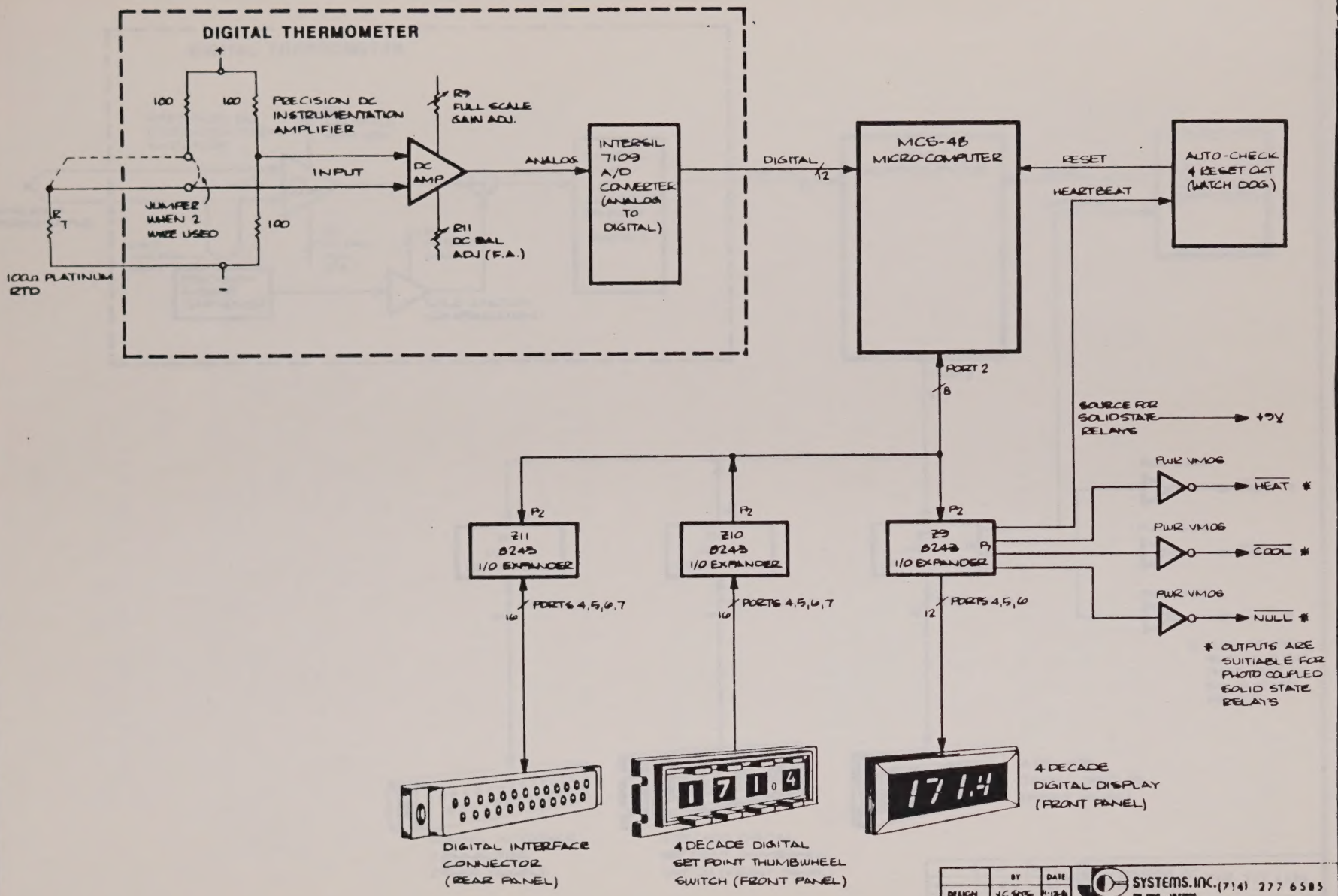
JC Systems' C81210 Temperature Controller is a high-precision, microcomputer based temperature controller which uses digital techniques to control temperature systems. It has no moving parts such as cams, gears or slide wires. Brown-out protection for the microcomputer is built in, as well as open thermocouple protection circuitry.

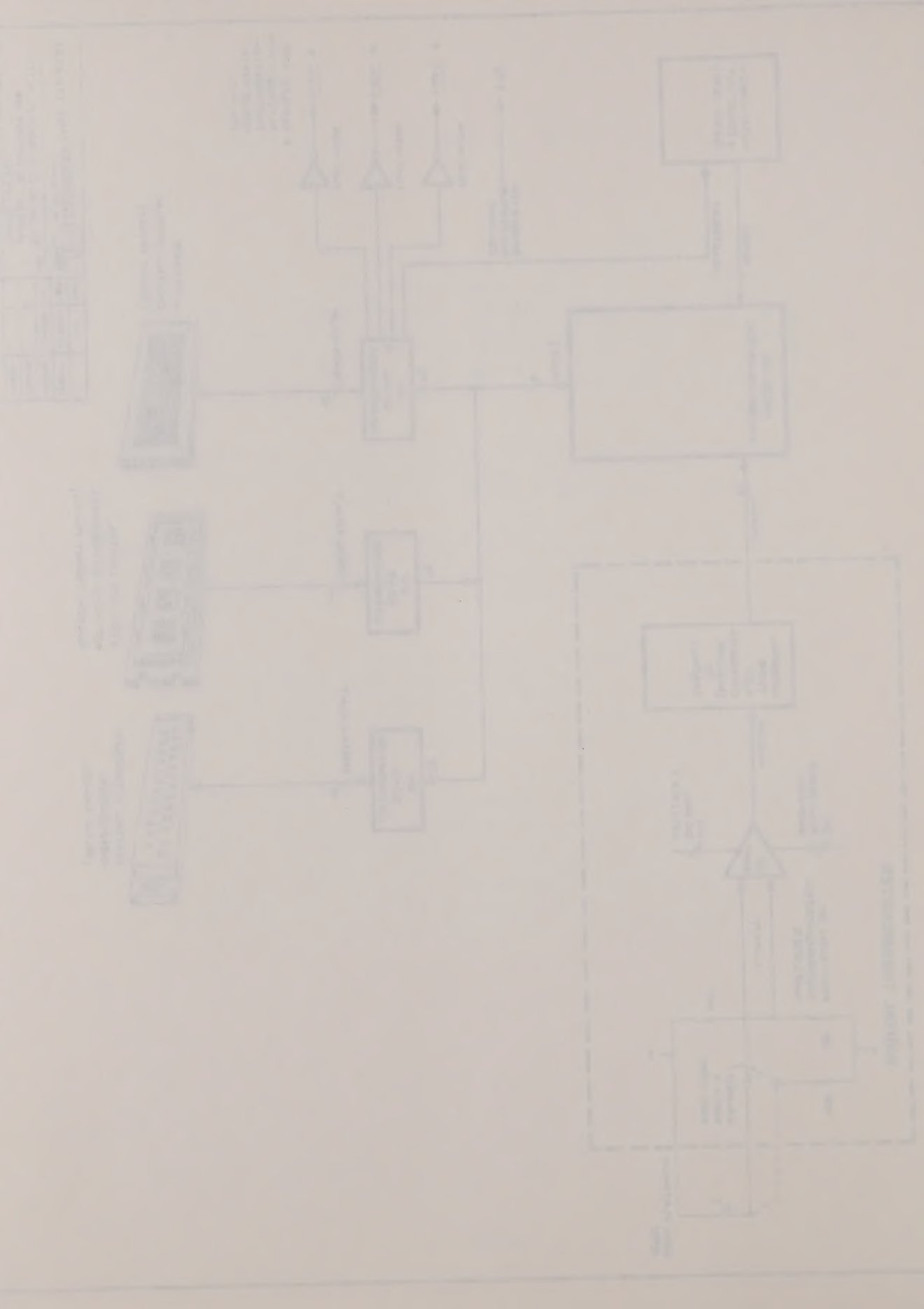
A Computer Interface Socket is provided on the rear panel to allow remote Setpoint selection and Process Temperature reading by an external Computer System.

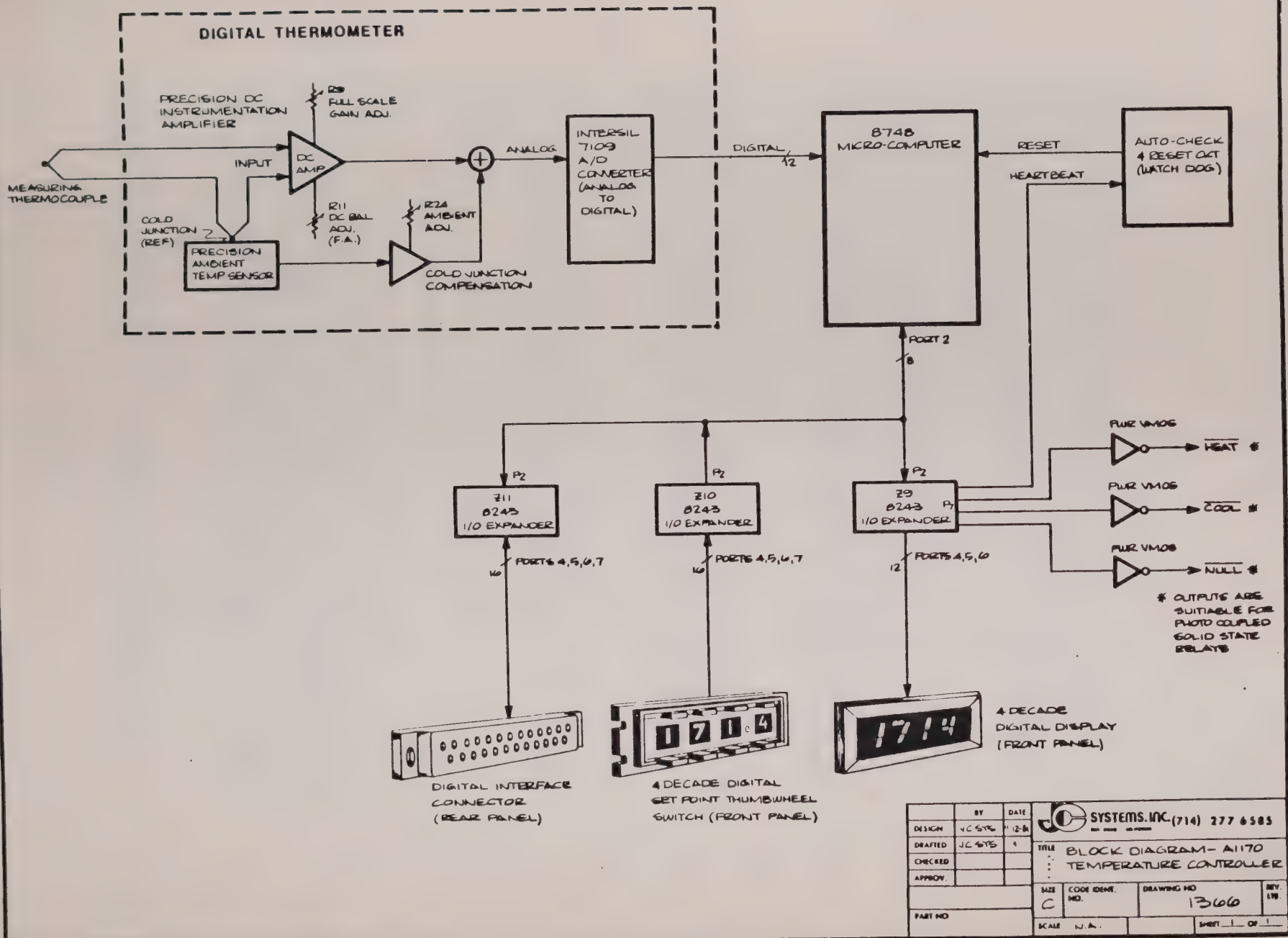
The controller's microcomputer automatically regulates heat and coolant in the controlled environment by providing time proportioning or power proportioning outputs. (Power Proportioning Output 4-20 ma. or 0-16 ma. option available.)

Input to the controller is from a type J, K, or R thermocouple (only one thermocouple can be used with a particular controller and temperature range). The microcomputer compares the signal from the thermocouple to the setpoint selected on the digital thumbwheel switches.

Other digital functions are also performed, including integral feedback, rate feedback and correction of the non-linearities in the thermocouple's response. The controller uses these values to automatically adjust variables in its temperature control program. This improves the settling characteristics of a system and results in precise control, steady rates of temperature change, reliable repeatability and highly stable control at the setpoint.


DIGITAL THERMOMETER
100
100
PRECISION DC INSTRUMENTATION AMPLIFIER
R9 FULL SCALE GAIN ADJ.
INPUT
DC AMP
ANALOG
INTERSIL 7109 A/D CONVERTER (ANALOG TO DIGITAL)
DIGITAL 12
MC6-48 MICRO-COMPUTER
RESET
HEARTBEAT
AUTO-CHECK & RESET CKT (WATCH DOG)
JUMPER WHEN 2 WIRE USED
R T
100
R11 DC BAL ADJ (F.A.)
100Ω PLATINUM RTD
PORT 2
8
SOURCE FOR SOLIDSTATE RELAYS
+5V
PWR VMOS
HEAT *
COOL *
NULL *
* OUTPUTS ARE SUITABLE FOR PHOTO COUPLED SOLID STATE RELAYS
P2
Z11 8243 I/O EXPANDER
Z10 8243 I/O EXPANDER
Z9 8243 I/O EXPANDER
P1
16 PORTS 4,5,6,7
16 PORTS 4,5,6,7
12 PORTS 4,5,6
DIGITAL INTERFACE CONNECTOR (REAR PANEL)
4 DECADE DIGITAL SET POINT THUMBWHEEL SWITCH (FRONT PANEL)
4 DECADE DIGITAL DISPLAY (FRONT PANEL)
1714
BY
DATE
DESIGN
DRAFTED
CHECKED
APPROV.
PART NO
SYSTEMS. INC. (714) 277 6585
TITLE: BLOCK DIAGRAM-- RTD INPUT" TEMPERATURE CONTROLLER"
SIZE C
CODE IDENT NO
DRAWING NO 1405
REV LTR
SCALE N.A.
SHEET 1 OF 1





	BY	DATE
DESIGN	J.C. SYS	11-28-84
DRAFTED	J.C. SYS	9
CHECKED		
APPROV.		

PART NO

SYSTEMS, INC. (714) 277 6585

TITLE: BLOCK DIAGRAM - A1170 TEMPERATURE CONTROLLER

SIZE C | CODE IDENT. NO. | DRAWING NO 13066 | REV. LTR.

SCALE N.A. | SHEET 1 OF 1

1.1. Function

The signal from the thermocouple is amplified by a differential DC solid state feedback amplifier and is applied to the input of a 12 bit dual slope A/D converter. The A/D converter incorporates automatic zero drift compensation and has a conversion rate of 7.5 per second. The converted sensor output signal is processed by the controller's microcomputer.

System temperature is continuously displayed to 0.1 deg. (1.0 deg. for high temperature models).
The control is proportional, integral and derivative control (PID) with the parameters being digitally selectable on DIP Switches located on the Controller PC board. The Cycle Time is also digitally selectable when the Controller is in operated in a "Time Proportioning Mode".

1.1.1. Controlled Equipment

The C81210 Temperature Controller may be used with any type of temperature control application within the unit's temperature range. Typical applications include kilns, environmental chambers and distributed temperature systems.

1.2. Packaging

The controller is supplied with a baked enamel front and back panel attached to a steel chassis. In this configuration, the unit is ready for installation in the equipment to be controlled.

Optionally, enclosure covers are available.

1.3. Related JCS Equipment

1.3.1. IEEE-488 Double Port Interface

The Double Port Interface may be used to set temperature, read temperature and issue commands to the temperature controller. It includes two independent ports so that two temperature controllers or one temperature controller and one piece of additional equipment may be operated by a bus controller such as the Fluke 1702A Instrument Controller, the HP 9825, or the Commodore PET Microcomputer.

1.3.2. JCS Rate Programmer

Temperature sequences, including rate of temperature change, setpoint temperature, duration at a particular

temperature and three external events may be pre-programmed using the JCS Rate Programmer. A built-in digital connector on the temperature controller permits easy interface of the two units.

1.3.3. TempCertifier

The JCS TempCertifier has six pre-programmed temperature sequences, featuring those most commonly used in environmental testing. A printer option provides "hard copy" verification of thermal control functions.

1.4. Specifications

Repeatability: plus or minus 0.1 deg. (plus or minus 1.0 deg. for high temperature ranges)

Cold Junction Compensation: built in, 0.01 deg./degree

Control Mode: digital - THREE MODE (Proportional, Integral and Derivative "PID") with Digitally selectable Reset Windup Inhibit.

Display Update Rate: 7.5 readings per second

Power: 117 VAC 50/60 Hz 15 Watts

Calibration: ambient and full scale only

Time Proportioning Automatic Heat - Cool

CYCLE TIME: Selectable 1 sec. to 255 sec. by means of DIP Swiches.

PROPORTIONAL GAIN: Selectable by means of DIP Switches from 1 to 255.

NOTE: A SETTING OF "0" AS THE PROPORTIONAL GAIN RESULTS IN THE TEMPERATURE CONTROLLER FUNCTIONING AS AN ON-OFF CONTROLLER WITH THE DEAD BAND (DIFFERENTIAL GAP) SELECTED BY THE SETTING ON THE CYCLE TIME DIPSWITCH).

AUTOMATIC RESET (Integral Action): Selectable by means of DIP Switches from 0.00 Resets/Minute to 163.83 Resets/Minute.

RATE (Derivative Action): Selectable by means of DIP Switches from 0.0 to 12.7 Minutes.

RESET WIND-UP INHIBIT: DIP Switch selectable from 1% to 100% of the Proportional Band Width.

HEAT & COOL OUTPUTS: Logic outputs, max. load voltage 40 VDC, 500 mA max. sink. (suitable for driving photo-isolated solid state relay or control relay.)

2. INSTALLATION

2.1. Mounting

The temperature controller is generally mounted directly in the controlled equipment by its front panel. (Ref. Figure 2-1.) It is designed to mount into a standard 1/2 DIN opening.

When planning installation, be sure to leave adequate space for interconnecting a thermocouple and accessory cables at the back of the unit. (Ref. Figure 2-2.)

2.2. Interface

2.2.1. Thermocouple

A Thermocouple which is installed in the controlled environment must be connected at TB 1-1, 2, 3 on the back panel of the controller. A label on the back of the unit specifies the thermocouple type.

2.2.2. Double Port Interface (IEEE-488)

When the temperature controller application calls for all equipment to be operated by a bus controller or similiar equipment, interconnection with the Double Port Interface is required. This is accomplished by connecting the interface cable to the remote connector (J1) on the back panel. Refer to the Double Port Interface instruction manual for additional installation guidelines before proceeding.

2.2.3. JCS Rate Programmer

Interconnection between the temperature controller and rate programmer is accomplished with the cable provided with the programmer. It is connected to the remote connector (J1) on the back panel of the temperature controller.

2.2.4. TempCertifier

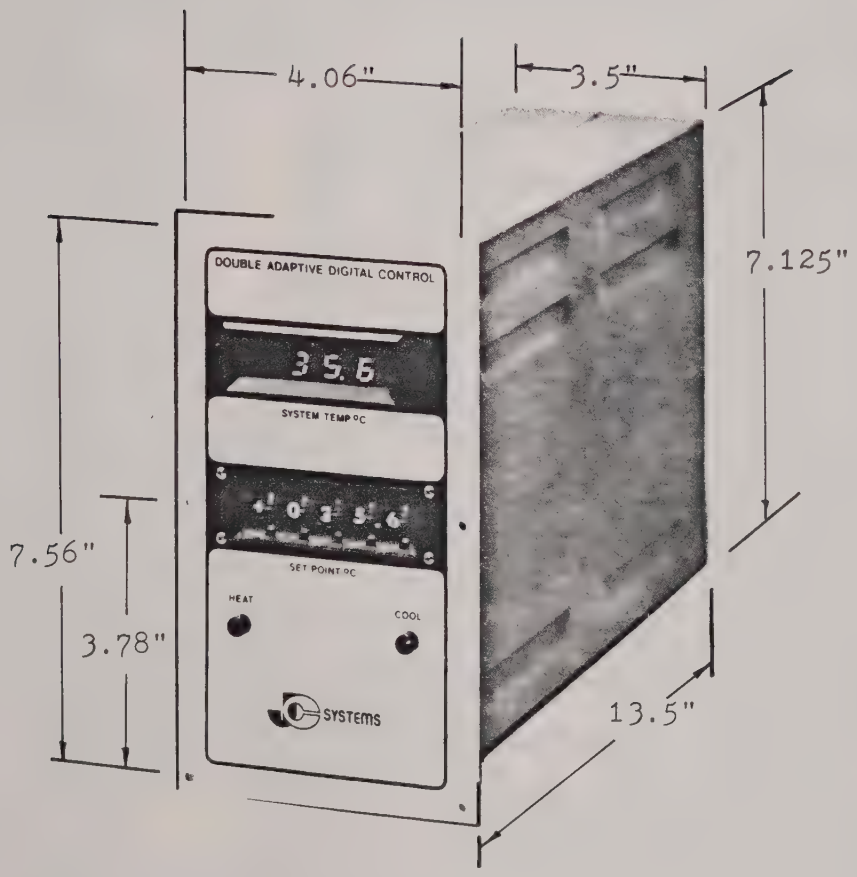


Figure 2-1
Front Panel View

J1
OUT OFF
+8V UNREG
HEAT LOGIC
COOL LOGIC
AUX OUTPUT
0V
SYSTEMS, INC.
CAUTION:
CONNECT TO
GROUNDED
OUTLET FOR
OPERATOR
SAFETY
F1
1/2A
117V

The JCS TempCertifier is also interfaced at the remote connector (J1).

NOTE: ONLY ONE (1) TEMPCERTIFIER, DOUBLE PORT INTERFACE OR RATE PROGRAMMER MAY BE CONNECTED AT ONE TIME.

2.3. Power Connection

Plug in the power cord. Power requirement is indicated on the label on the back panel; -1 is for 117 VAC and -2 is for 230 VAC; 50/60 Hz.

2.4. Output Connections (Typical Applications)

2.4.1 Time Proportioning

Make heat and cool connections at TB1-6,7,8 as shown in Figure 2-3. This figure shows connection of a photo-coupled solid state relay, solenoid valve and heater.

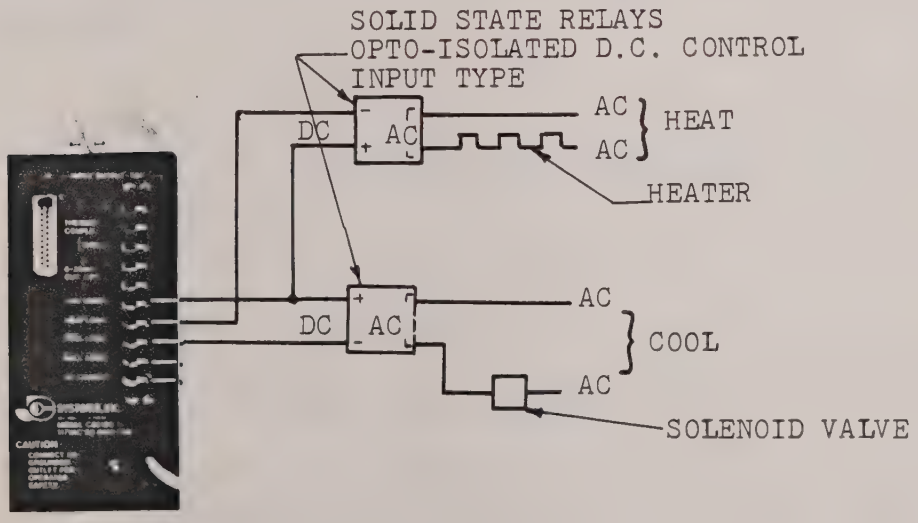


Figure 2-3
Connections for Time Proportioning Outputs

2.4.2 Current Loop (when option ordered)

Figure 2-4 shows connections for current loop output using a relay and unregulated power supply.

2.5. Calibration

Prior to using the temperature controller, it must be calibrated for ambient and full scale settings following the procedure outlined below.

Equipment Required:

Thermocouple Calibration Standard (such as WAHL Instruments Model C-65 or BIDDLE Model 720350

Thermocouple extension wire for the type unit

Temperature Sensor for measuring ambient temperature

PROCEDURE

Ambient Calibration

1. Connect the Calibrator to the Input of the Temperature Controller with the Thermocouple Extension wire.

2. Measure the Ambient Temperature.

3. Turn on temperature controller power.

4. Set the Calibrator Output to the value of the measured Ambient Temperature.

5. Adjust the AMBIENT pot, (R24) on the controller p.c. board, until the reading on the digital display of the temperature controller matches that of the calibrating device.

FULL SCALE CALIBRATION

1. Set the Calibrator to the specified calibration temperature as applicable for the type of controller.

2. Adjust the SLOPE pot (R9) on the controller p.c. board until the display reading matches that on the Calibrator device.

3. Calibration is now complete.

4. Calibration should be verified by insuring that the displayed temperature on the controller tracks the value selected on the Calibrator.

3.0 OPERATION

3.1. Power Up

Power to the controller is supplied through the equipment it controls. The heat and cool lights will come on and the controller will immediately begin to reach the setpoint temperature.

3.2. Heat and Cool Lights

The heat light is on solid while the controller is working toward a higher setpoint and off when the environment is cooling down. When the setpoint is reached, the light blinks.

3.3. Remote Mode

The Computer Interface Socket (J1) on the back of the controller is designed so that taking Pin 12 (Remote Interface Control) low puts the temperature controller in the Remote Mode. This may be done intermittently, depending on the type of equipment interfaced.

This connector is used with the JCS Rate Programmer, TempCertifier, Double Port IEEE-488 Interface or special application programs. It accepts 16 lines I/O and two handshake lines. The I/O lines may be steady state (BCD), latched input or bidirectional computer interface.

3.4. Temperature Setpoint Switch

Five thumbwheel switches are provided for setting temperature. The first switch sets plus or minus, the remaining four set temperature with a fixed resolution of 0.1 deg. or 1.9 deg., depending on the temperature range. (High temperature range models do not have + or - sign.)

Overrange protection is built in so that if a temperature that is out of range is dialed on the setpoint switches, "----" appears on the display.

3.5. Temperature Display

Actual system temperature is digitally displayed continuously on the front panel. This shows ACTUAL system temperature while the setpoint temperature is indicated on the thumbwheel switches.

If a rate programmer is being used, refer to the rate programmer manual for an explanation of front panel indications.

3.6. Normal Operation

All temperature control functions occur automatically after power is turned on.

3.7. Shutdown

To turn off the temperature controller, simply turn off system power.

3.8. Failure Modes

The display on the front panel of the controller will give the following error messages:

P.OP = Probe Open.

If the temperature controller's probe opens, the controller's heat and cool outputs are automatically turned off.

---- = invalid or overrange setpoint. (Heat and cool are automatically turned off.)

4.0. ADJUSTING THE SYSTEM PARAMETERS

There are five different parameters and a utility switch that can be adjusted in a Time Proportioning application. These parameters and their respective DIP Switches utilized for setting values are as follows:

PROPORTIONAL GAIN	(P)	S6
AUTO RESET	(I)	S3 AND S2
RATE	(D)	S5
RESET WIND-UP INHIBIT		S4
CYCLE TIME		S1

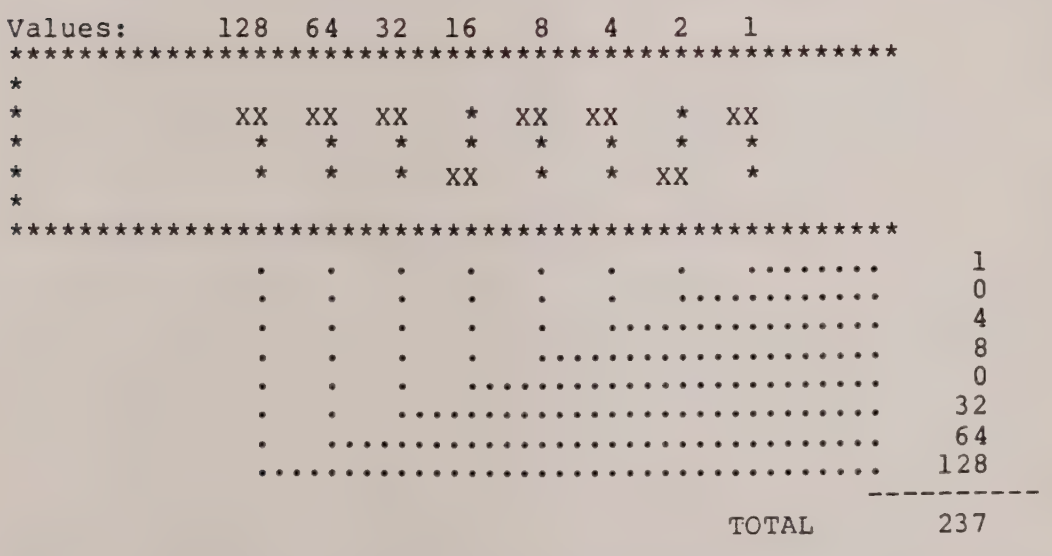
UTILITY SWITCH:
C OR F OPERATION S7
REVERSE/DIRECT ACTION
(Current Loop operation)

The parameters are adjusted by means of DIP switches that are located along the top of the controller board. An example of one of the switch adjustments is shown below:

SETTING THE SWITCHES FOR DESIRED VALUES OR PARAMETERS

Example: Set a switch for 237

Note: XX means that switch is set to shown position



Each of the DIP switches has 8 rocker elements. The individual rocker is changed by pushing down on the appropriate end to either select the bit or zero it.

PROPORTIONAL GAIN S6

The Proportional Gain is the ratio of the SETPOINT SPAN (600 DEGREES C.) TO THE PROPORTIONAL BAND.

$$\text{PROPORTIONAL GAIN} = \frac{600 \text{ DEGREES C.}}{\text{PROPORTIONING BAND (DEGREES C.)}}$$

The Proportioning Band is the Deviation between Process Temperature and Setpoint Temperature. It is the error in degrees C that produces an output of 100% power to the heaters. Consequently, the greater the Proportional Gain the smaller the Proportional Band. Too high a Proportional Gain Setting produces uncontrolled cycling and an unstable system. If you desire proportioning action over a 60 degree C band, set a Proportional Gain of 600/60 which is equal to 10.

4.2. RESET ACTION S3 & S2

Reset Action is also known as Integral (the I in PI control) and serves to compensate for the "droop" that occurs in a Proportioning system without an infinite Proportional Gain.

4.3. RATE S5

Rate Action is typically used with "slow or sluggish systems". It produces a corrective compensation that is a function of the time rate of change of the process temperature only.

4.4. RESET WIND-UP INHIBIT S4

Reset Wind-Up Inhibit is a function that helps to alleviate a problem that can occur in a system that takes a long time to heat up or cool down in a "step function" type of programming. When a system is given a large change in Setpoint, and the system cannot respond rapidly, a large Deviation exists during the time that the system is heating or cooling to the value selected by the new Setpoint.

During this time, the Deviation (process temperature minus the Setpoint temperature) has a large value and when integrated over a long time, can produce a large "Reset Correction". This corrective term is present in the controller when the process temperature becomes finally equal to the setpoint and must be "integrated out" for the system to settle down and finally reach equilibrium.

This action is referred to as "Reset Wind-Up" and will cause damped temperature oscillations around the Setpoint because the Reset Function has had large errors (or Deviations) to work on during the time the system has been changing temperature.

This undesirable characteristic can be eliminated or minimized by making use of the capability of your C81210

Controller. The maximum Deviation that the reset action will integrate can be set as a percentage of the Proportioning Band on switch S4. A setting of 0 is the same as 100% which is the maximum setting (all higher values default to 100) which is actually the minimum amount of Reset Wind-Up Inhibit action.

Reset Wind-Up usually is only a problem in slow or sluggish systems.

4.5. CYCLE TIME S1

The Cycle Time Switch allows the time period for the Time Proportioning ON-OFF action to be adjusted from a value of 1 second to 255 seconds. Typically the longer the time period the better for mechanical relays, as the control must turn ON and OFF during the cycle time.

The maximum time setting is limited by the thermal response of the system. Too long a cycle time for the system results in the temperature of the system varying as the heat is applied during the proportioning cycle.

Note: A setting of 0 defaults to 1 second.

5.0 USING THE COMPUTER INTERFACE PORT

THE COMPUTER INTERFACE PORT
(J1 ON REAR PANEL)

Pinouts and	Functions
1	.1 TENTHS
14	.2 TENTHS
2	.4 TENTHS
15	.8 TENTHS
3	1 UNITS (BCD)
16	2 UNITS
4	4 UNITS
17	8 UNITS
5	10 TENS (BCD)
18	20 TENS
6	40 TENS
19	80 TENS
7	100 HUNDREDS (BCD)
20	200 HUNDREDS
8	400 HUNDREDS
21	MINUS TEMPERATURE
9,10,22,23	LOGIC COMMON
11	DO NOT USE
24	READ TEMPERATURE COMMAND (LO = READ TEMPERATURE)
12	REMOTE CONTROL (LO = REMOTE)
25	SETPOINT VALID COMMAND (HI = BCD LINES HAVE VALID DATA)
13	DO NOT USE

5.1 OUTPUT DRIVE CAPABILITY ON PINS CONTAINING BCD DATA - OUTPUTS ARE FROM INTEL 8243 I/O DEVICE WITH 22K PULL UP RESISTOR TO +5 VDC. LOGIC HI TRUE ON BCD INFORMATION LINES.

5.2 COMMAND INPUT LINES (PINS 12, 24, AND 25 CONNECTED TO NMOS INPUTS WITH 10K TO 22K PULL UP RESISTORS TO 5 VDC.

5.3 INPUT INTERFACE FROM COMPUTER MUST BE 5 VOLT LOGIC LEVELS WITH "0" VOLTS CONNECTED TO CONTROLLER LOGIC COMMON

5.4 DESCRIPTION OF OPERATION OF INTERFACE PORT

5.4.1 The interface to the temperature controller is actually very simple. The microcomputer on the temperature control looks for four decades of BCD information on an I/O port (actually an Intel 8243 device). The microcomputer thus determines the system SETPOINT as information present at the the inputs to the 8243 I/O.

5.4.2 A SETPOINT VALID input signal from the interface connector is utilized to convey information to the processor regarding the validity of the BCD information at the input to the 8243 I/O chip. A HI Setpoint Valid signal is an indication to the processor that the information at the input to the 8243 chip is valid and is not changing.

5.4.3 Dropping the Setpoint Valid signal tells the processor that the BCD information at the input to the 8243 I/O chip will remain valid for an additional 80 microseconds minimum and causes the processor to store the setpoint information in internal RAM memory for reference until the DATA VALID line goes HI again.

5.4.4 Two separate "Setpoint I/O" devices are provided on the controller. The selection of the I/O device utilized to read the required SETPOINT is determined by the logic level on the REMOTE CONTROL INPUT (Pin 12 on the Computer Interface Receptacle). A LO logic level selects the I/O chip Z15 (connected directly to the Remote Temperature socket (J5 on the circuit board assembly). A HI logic level on pin 12 of the rear panel interface Receptacle causes the computer to read its SETPOINT from I/O device Z4 and the related panel Mounted Digitswith.

5.4.5 When the controller is used in an environment where all of the setpoint input is via the remote computer interface connector, Pin 12 should be taken LO and kept in the LO state and the setpoint latched on the I/O BCD lines. In this manner, the current SETPOINT is the four decade BCD information connected to the remote interface connector.

5.4.6 NOTE: Please observe that the pin outs on the board mounted receptacle (J5) do not agree with the pin out numbers on the Computer Interface Connector which is located on the rear panel of the temperature controller. The lines in the ribbon cable correspond to the pinouts on J5 (the p.c.mounted receptacle on the circuit board). The Computer Interface Connector is a "ribbon cable mass terminated "D" subminiature 25 pin receptacle and the mass termination results in the pin outs on the connector not following lines in the ribbon cable. Consequently, the pin numbers on J5 as shown on drawing number 1269 do not agree with the pin numbers on the rear panel mounted "Computer Interface Connector".

5.5 WRITING A SETPOINT TO THE TEMPERATURE CONTROLLER VIA THE INTERFACE CONNECTOR

1. Line 12 must be LO and kept LO (logic 0 causes use of the I/O device (Z15) associated with the Computer Interface Connector

2. Latch the BCD Setpoint information onto the data lines of the Interface Connector. (HI = logic true).

5.6 READING THE PROCESS TEMPERATURE VIA THE COMPUTER INTERFACE CONNECTOR

Reading the system temperature via the Computer Interface Connector consists of five steps:

1. Take the Setpoint Valid Line LO to the Computer Interface connector (Pin 25). Keep the data on the BCD lines latched for another 120 microseconds so as to allow the microcomputer of the temperature controller to store the Setpoint in its internal memory.

2. Tri-state the data lines connected up to the BCD connections on the Controller Computer Interface Connector. This gets the users computer ready to read the data that the temperature controller will output on the interface port.

3. Take the READ TEMPERATURE line LO (Pin 24) and look for the BCD character to appear on the Most Significant Decade (MSD) as that is the indication that the information is present at the output. Until the information is ready to be read, the information present at the MSD (pins 21,8,20, and 7) will be all logic highs (F hex).

4. Take the READ TEMPERATURE LINE HI (Pin 24). This action latches the data on the output of the Temperature Controller and the latched data can be read without any concern about it changing in the middle of the computer read.

5. After the data is read, take the SETPOINT VALID line HI and latch the setpoint data on the data lines for the Temperature controller.

An alternative to the above procedure is to follow the steps 1 and 2 above then proceed as follows:

3. Take the READ TEMPERATURE line LO and then wait for 330 milliseconds then take the READ TEMPERATURE line HI

4. Wait for 60 microseconds then read the Setpoint Temperature on the BCD data lines. This data has

been latched and the last 60 microseconds wait insured that the data was stable and not changing.

5. After the data has been read, take the SETPOINT VALID line HI and latch the Setpoint BCD data on the data lines going to the Computer Interface Connector.

6.0 MAINTENANCE AND REPAIR

Keep the interior of the controller relatively clean. Stray bits of wire can cause shorting and damage to components.

6.1. Replacing Modules

Functions in the temperature controller are performed by p.c. board modules. If a faulty module is suspected, it can be easily removed and replaced.

6.2. Replacing Thermocouple

If a thermocouple opens, it is easily removed and replaced with another thermocouple at TB1-1, 2 & 3.

6.3. Recalibration

Recalibration is seldom necessary; however, if the controller is placed in another application or if the controlled environment's configuration is altered, recalibration may be required.

Recommended calibration interval is one year.

6.5 DIAGNOSTICS

A complete DIAGNOSTIC CAPABILITY is provided in your controller allowing trouble shooting and verification of hardware operation.

The following tests are used to check out the physical hardware as each test operates a particular I/O device and the displays or switches associated with that particular I/O device. Each bit selection on the various switches may be tested and the proper operation of all of the I/O hardware verified.

6.5.1 DIAGNOSTIC PROCEDURE: POWER UP WITH SETPOINT SWITCH SET TO -5000

Switch the AC power off and uplug any accessories connected to the controller interface plug (such as a RATE PROGRAMMER or IEEE-488 INTERFACE).

-5000

DISPLAY TEST

Set in -500.0 on the front panel SETPOINT switch and turn

the AC power ON to put the Temperature Controller in its diagnostic mode of operation.

Verify that each digit of the display cycles through its entire character set (0-9,-,E,H,L,P) except for the most significant digit, which will not display the character "0". After cycling the display, the diagnostic program will momentarily turn on decimal point 1 (xxx.x), decimal points 3 & 0 (x.xxx.), the NULL, and COOL ouputs in sequence.

NOTE: DIALING A "1" IN THE LEAST SIGNIFICANT SETPOINT DECADE CAUSES THE PROGRAM TO EXPEDITE THE TEST.

-5009

SETPOINT SELECT SWITCH TEST

Dial -5009 on SETPOINT Switch. Observe that the display echos back the setting of the SETPOINT Switch (except for the numbers -59xx as those number starting with "-59" are associated with the remainder of the tests.

NOTE: IF A CURRENT LOOP IS UTILIZED, THE CURRENT LOOP OUTPUT MAY BE TESTED BY SIMPLY DIALING IN FOUR (4) DIGITS ON THE SETPOINT SWITCH. 0000 GIVES THE MINIMUM CURRENT WHILE 4095 GIVES THE MAXIMUM VALUE. (The current loop is modulated by a 12 bit digital signal and 12 bits corresponds to a resolution of 1 out of 4096). 50% current output would occur when a setting of 2047 on the SETPOINT Switch. (The number on the SETPOINT Switch is the decimal equivalent of the binary combination of 12 bits.)

-5900

A/D "DATA VALID" TEST

Shows that the "data valid" output is being generated by the A/D converter. The Hi/Lo Byte Enable produced by the A/D converter results in an alternating H and L on the display.

-5902

COMPUTER INTERFACE HANDSHAKE AND CURRENT LOOP SELECT TEST

This test verifies that the Computer Interface Handshake Command inputs are being seen by the hardware. There are two handshake lines involved and are:

a. READ TEMPERATURE Command (PIN 24 on the DIGITAL INTERFACE CONNECTOR).

b. SETPOINT VALID Command (PIN 25 on the DIGITAL INTERFACE CONNECTOR).

The logic level of each of the above is shown on the display as an "H" or "L". The READ TEMPERATURE (PIN 24) status is read in the least significant decade of the display while the SETPOINT VALID (PIN 25) status is shown on the next most significant decade display position.

The status of the "current loop select bit" is low when the current loop is plugged into the socket J 1 and is indicated on the next most significant display decade.

```
Display      X X X
                .  .  .
                .  .  .  .  READ TEMPERATURE (PIN 24)
                .  .
                .  .  .  .  SETPOINT VALID (PIN 25)
                .
                .  .  .  .  CURRENT LOOP PLUGGED IN
```

-5903

MODE SELECT SWITCH TEST (S7)

An "H" or "L" shows the settings of the bits on Switch 7 on the display. Leave all bits in "H" state (push top of rocker).

-5904

CYCLE TIME/DEAD BAND SWITCH TESTS (S1)

Decimal number equivalent to the settings of the bits on S1 is presented on the DISPLAY.

-5905

AUTOMATIC RESET SWITCH TEST (S2)

The decimal equivalent of the LSB (least significant byte) is shown on the display. This value is determined by the settings on S2. The values can be from 0 to 255 (all bits LO and all bits HI).

-5906

AUTOMATIC RESET SWITCH TEST (S3)

This test checks the inputs from Switch S3 which is the MSB (most significant byte of the Automatic Reset value). The binary equivalent for the MSB can be from 0 to 63 as only 6 bits are used.

-5907

RESET WINDUP INHIBIT SWITCH TEST (S4)

Test presents the decimal equivalent of the settings on the Reset Windup Inhibit Switch (S4) on the digital display. The values will be between 0 and 127 as 7 bits on the switch are used.

-5908

RATE SWITCH (S5)

The decimal equivalent of the setting on the Rate Switch (S5) is displayed. The value will range from 0 thru 127 as 7 bits are utilized to select the desired Rate Feedback

-5909

PROPORTIONAL GAIN SWITCH (S6)

The setting of the Proportional Gain Switch (S6) is displayed as its decimal equivalent. The values can range between a display of "0" (which in reality is the on/off mode of operation) to a value of 255 which is the maximum proportional gain setting for the controller.

O P E R A T O R V E R I F I C A T I O N

O F

S Y S T E M A D J U S T M E N T S

THE FOLLOWING CODES (-5910 THRU -5919) ARE USEFUL TO VERIFY THE SYSTEM TUNING PARAMATERS SET INTO THE CONTROLLER. IN EACH CASE, THE ACTUAL PARAMATER IS DISPLAYED ON THE DIGITAL DISPLAY.

-5910

CYCLE TIME (DEAD BAND)

NOTE: The controller functions as a simple ON/OFF control when the Proportional gain is set to "0". Plugging in a Current Loop Module results in the cycle time being automatically selected at 1 sec. (The current loop is updated at a rate of once every second.) The setting of the CYCLE TIME SWITCH (S1) MUST BE 255 (MAXIMUM) for the current loop to operate. An error message is generated on the display if the current loop in connected and the Cycle Time Switch is not set properly.

-5911

FRACTIONAL PART OF AUTOMATIC RESET SWITCH SETTING.

The value that can be selected for the Automatic Reset ranges from 000.00 to 163.83 REPEATS/MINUTE. As the display on the front panel is only 4 digits, the AUTOMATIC RESET setting must be displayed in two segments. This is accomplished by displaying the fractional part (value to the right of the decimal point) when -5911 is dialed and the integral (whole) part when -5912 is selected.

-5912

AUTOMATIC RESET (Intergral part of setting)

Used in conjunction with -5911 to read the total value of the RESET ACTION.

-5913

RATE FEEDBACK (EXPRESSED IN TENTHS OF A MIN.)
The RATE action setting is displayed as as number between 0 and 12.7 minutes.

-5914

PROPORTIONAL GAIN (EXPRESSED IN UNITS)
The setting of switch S6 is presented as a number between 0 and 255.

-5915

SPAN (EXRESSED IN DEGREES AND TENTHS OF A DEGREE)
The Span of the system is presented when a -5915 is selected. The Span is defined as the difference between the maximum setpoint and the minimum value of the setpoint. NOTE: A negative temperature on the lower setpoint adds to the acutal value instead of subtracting from the figure.

-5916

PROPORTIONAL BAND (DEGREES AND TENTHS)
The actual Proportional Band is presented on the display when the "-5916" is set on the Setpoint Switch.

The Proportional Band is a function of the Span of the controller (fixed for different controllers) and the setting of the Proportional Gain slection switches. The Span of the controller is the difference between the maximum Setpoint value and the minimum Setpoint value. (A standard 0 to 600 degree C controller has a span of 600 degrees C.)

The Proportional Band for a specific Proportional Gain setting is equal to the SPAN devided by the PROPORTIONAL GAIN.

For example, the Proportional Band for a 600 degree span controller with a Proportional Gain setting of 10 would be equal to 600/10 or 60.

-5917

RESET WIND-UP INHIBIT BANDWIDTH (IN TENTHS OF A DEGREE)
The Reset Wind-Up Inhibit Bandwidth is displayed to a resulution of .1 degree.

-5918

LOWER SETPOINT LIMIT DISPLAY
The "Lower Setpoint Limit" is the lowest setpoint accepted by the controller. A lower setpoint results in the display of "dashes" and the disabling of both the "heat" and "cool" outputs of the controller. The Lower Setpoint Limit is presented on the display when the diagnostic program is evoked and a selection of -5918 is on the Setpoint Switch.

-5919

HIGH SETPOINT LIMIT DISPLAY

The "High Setpoint Limit" is displayed when a -5919 is selected in the diagnostic mode of operation.

-5920

WATCHDOG TIMER CIRCUIT CHECK

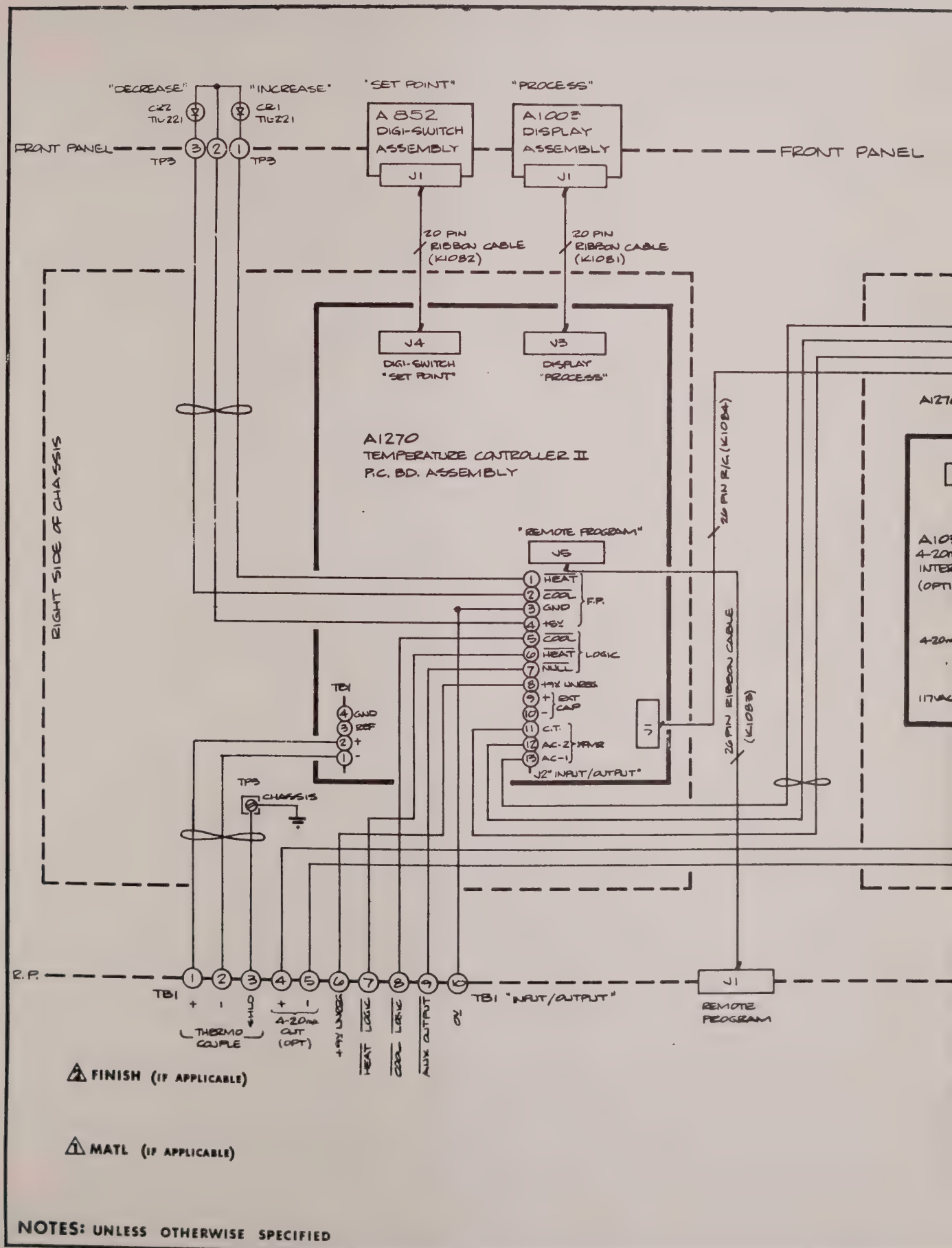
The system includes a "watchdog timer" which insures that in the event of a "brownout" or transient on the power lines sufficient to disrupt the operation of the microcomputer, an automatic "Reset to Start" command is generated. This function keeps the microcomputer from "getting lost". Dialing a -5920 causes the processor to quit generating check pulses to the "watchdog" and in approximately 4 seconds after the -5920 is dialed, the controller should reset and the display cycled through the digits. This activity is proof that the "watchdog timer circuit timed out and reset the system to its "start" condition.

-5940

EXERCISE DISPLAY AND OUTPUTS

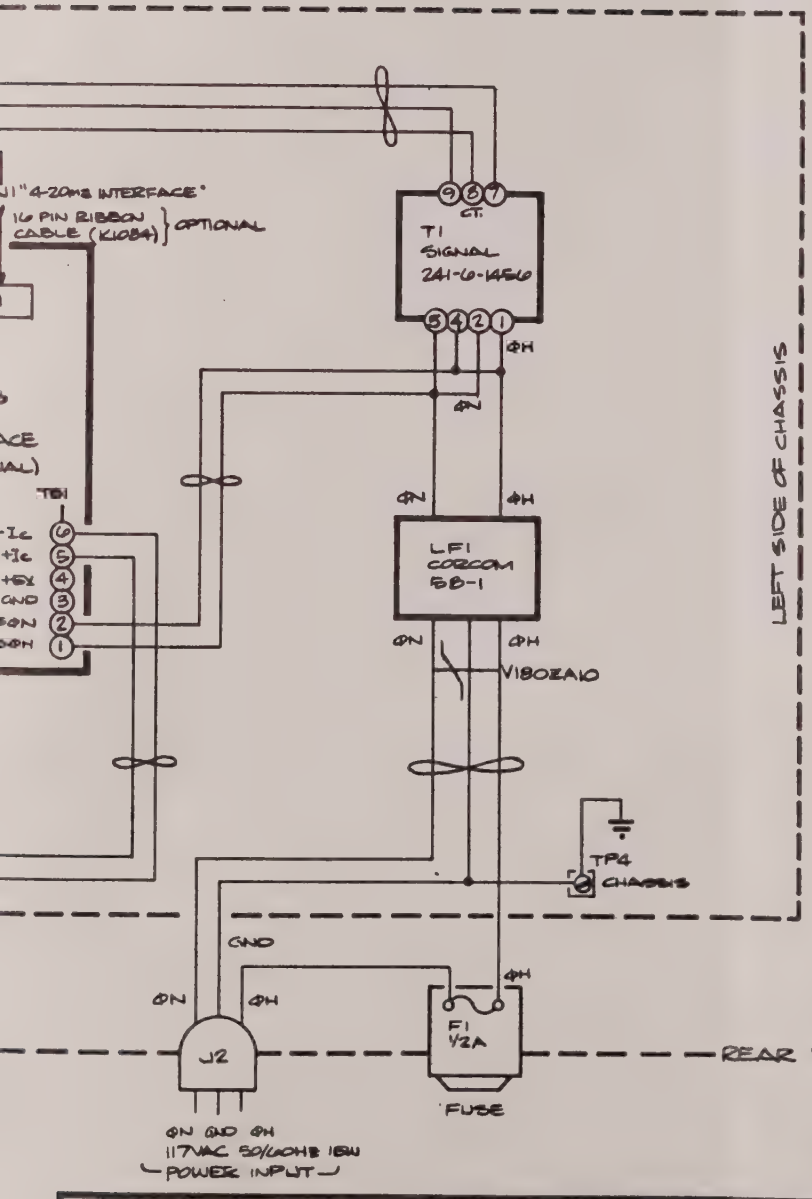
Selecting a -5940 on the Setpoint Switch when in the diagnostic mode of operation results in the processor starting through the display tests and cycles the various outputs so that the hardware may be checked.

C81210/MLC:Z3
8/82



NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS			
ZONE LTR	DESCRIPTION	DATE	APPD



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DASH	QTY	NEXT ASSY	USED ON
APPLICATION			

SERIAL NO.	DATE EFF	DWG REV
1 ΦN	7/8/81	NK
EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0° 30'
HOLE TOLERANCES

MATERIAL

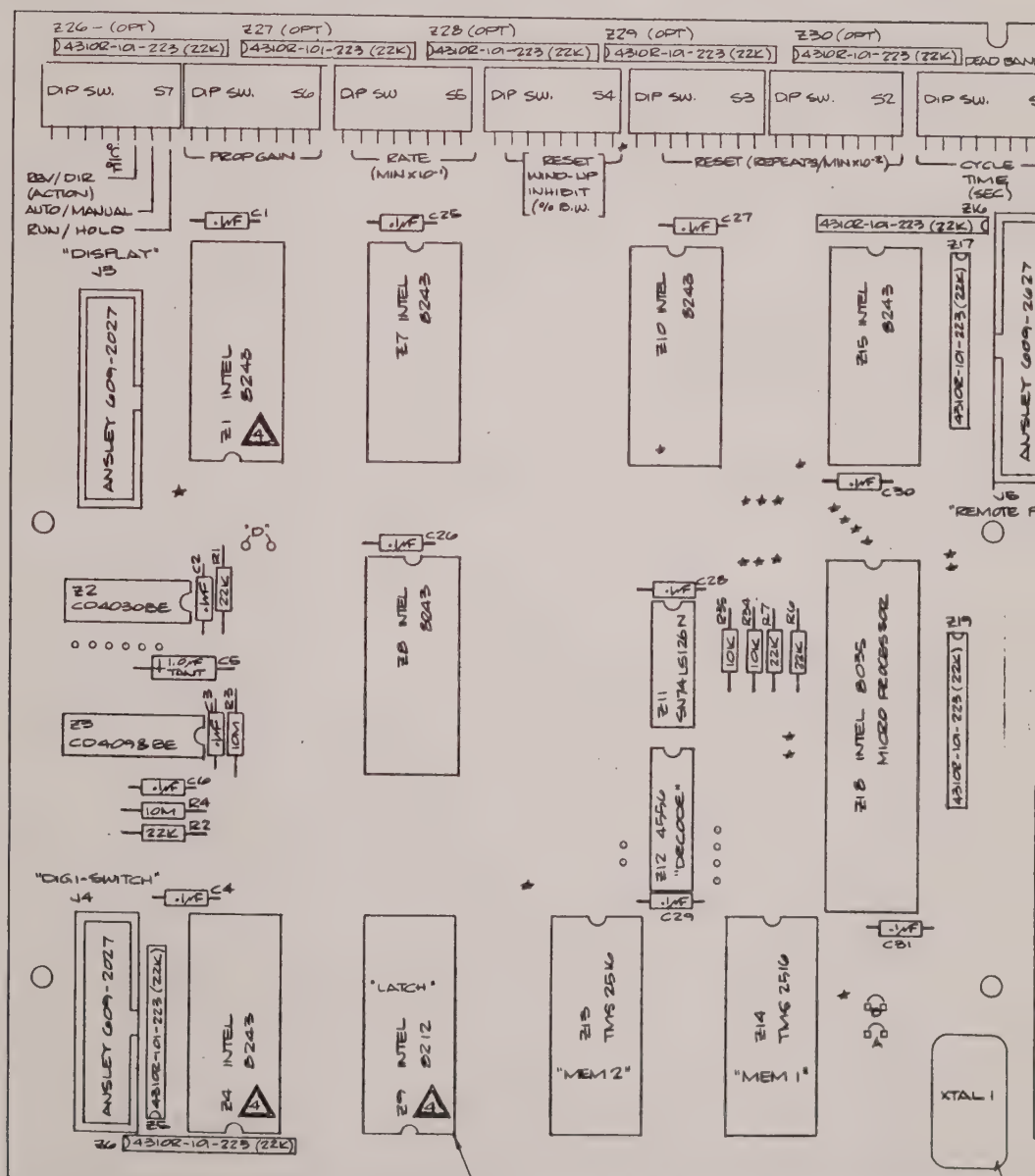
FINISH

ENGINEERING ACTIVITY	
DESIGN	JC SYSTEMS INC
DRAFTED	" 08 JULY 1981
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

JC SYSTEMS, INC.

TITLE: WIRING DIAGRAM - TEMPERATURE CONTROLLER II MODEL CB1210

SIZE	CODE IDENT		
D		1317	A1
SCALE N.A.		SHEET 1 OF 1	



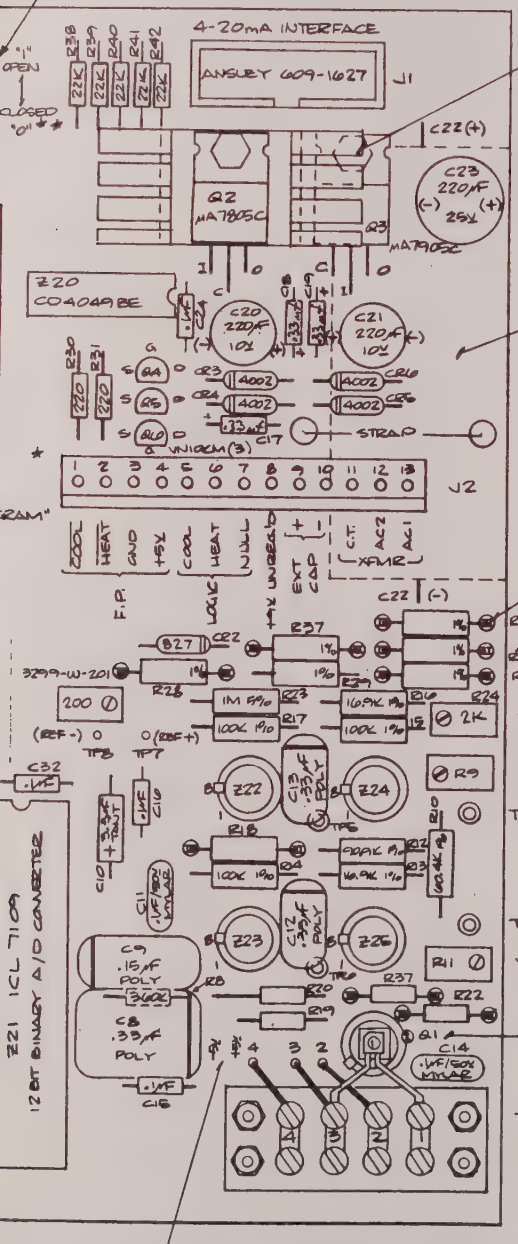
NOTES: UNLESS OTHERWISE SPECIFIED

*NOTE: DO NOT DIP CLEAN (SUBMERGE) BOARDS WITH DIP SWITCHES INSTALLED (S1-S7)

DO NOT INSTALL SOCKETS FOR DIP SWITCHES S1-S7

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE	APPD

SEE SCH 1269 SHT 1



THERMALLOY HEAT SINKS 6070B & 6071B (FOR Q2 ONLY)

FACTORY SELECT:
C22 8000µF @ 15V CAN BE MOUNTED FARSIDE OR CAN BE MOUNTED REMOTE VIA J2 PINS #9 & #10

INSTALL NEARSIDE TERMINAL (CAMBION) 140-2089-02-01-00 (10) (R8, R25A, R25B, R26, R27, R28, R22, R37)

⚠2 FOR VALUES SEE "RESISTOR SELECT CHART" IN REF MANUAL

"AMBIENT" 3299-W-202

"SLOPE" 3299-W-203
TP4 - SLOPE

TP2 - BALANCE

"BALANCE" 3299-W-203

} ALL POTS ARE TOP ADJUST TYPE (4)

① THERMOCOUPLE TYPE "J"
② Q1-AD590K

} BOND WITH 5 MIN. EPOXY

(OPTIONAL OTHER THAN SHOWN)
F.A. R19 & R20 CAN BE INSTALLED TO +5V(A) OR TO -5V(A)

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	1	END ITEM		1 #ON	2/13/81	NK			
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV			
APPLICATION				EFFECTIVITY					

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.013 THRU .135 +.004 -.001 .141 THRU .500 +.004 -.001
.134 THRU .250 +.005 -.001 .501 THRU .750 +.005 -.001
MATERIAL ⚠1
FINISH ⚠2

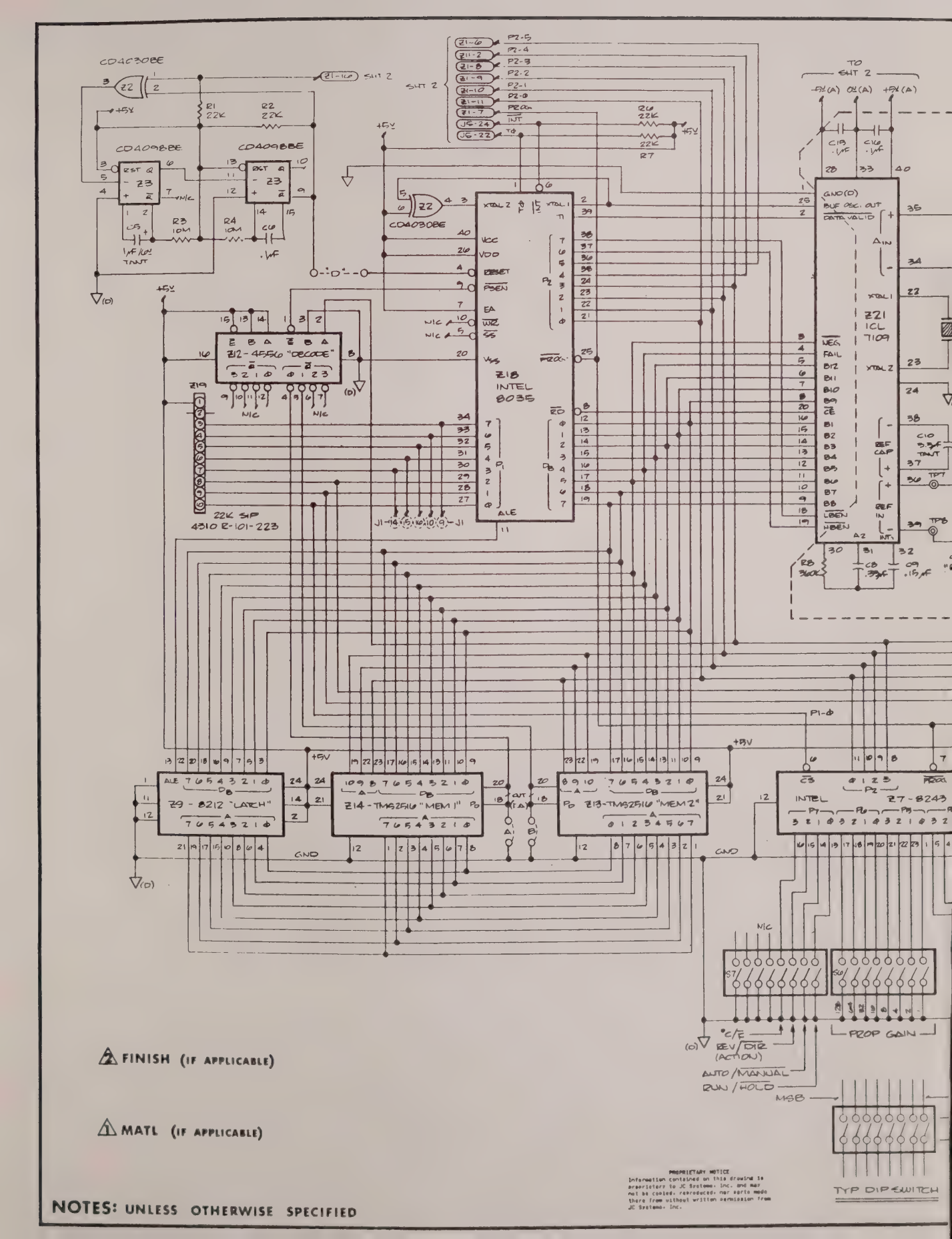
ENGINEERING ACTIVITY		
DESIGN	JC SYSTEMS INC	
DRAFTED	" 13 FEB 1981	
CHECKED		
APPROV		
RELEASE		
DO NOT SCALE DWG		

JC SYSTEMS, INC.
SAN MARCO CALIFORNIA

TITLE: PRINTED CIRCUIT BD ASSY— TEMPERATURE CONTROLLER II MODEL A1270

SIZE	CODE IDENT	
D		1270- C1

SCALE 2:1 SHEET 1 OF 1


NOTES: UNLESS OTHERWISE SPECIFIED
⚠1 MATL (IF APPLICABLE)
⚠2 FINISH (IF APPLICABLE)
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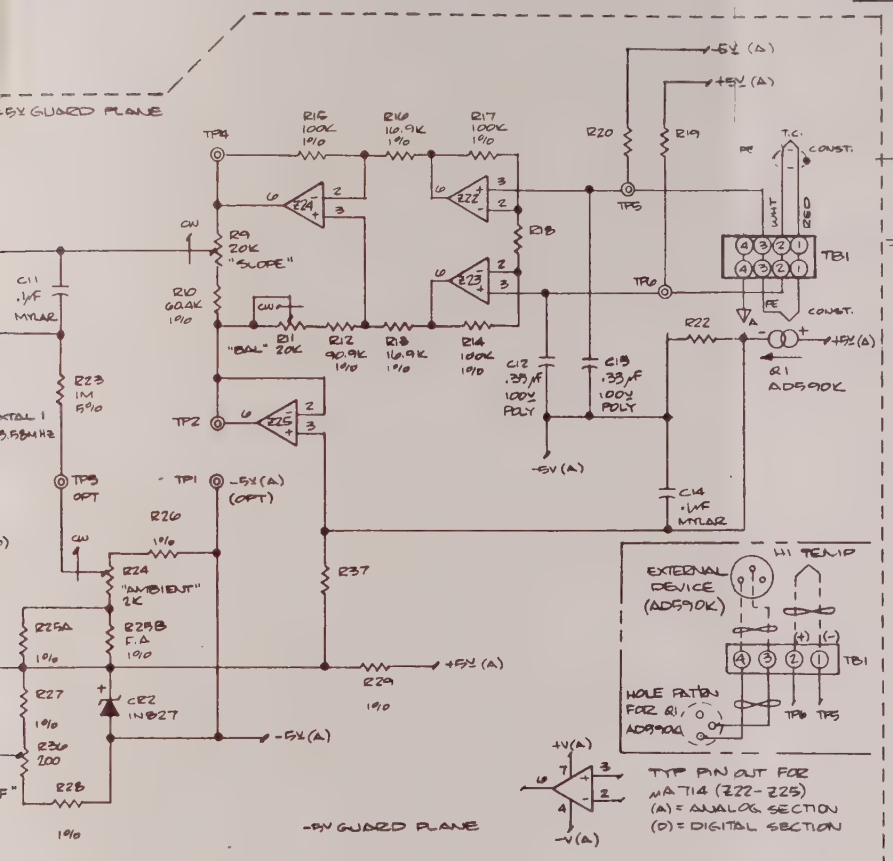
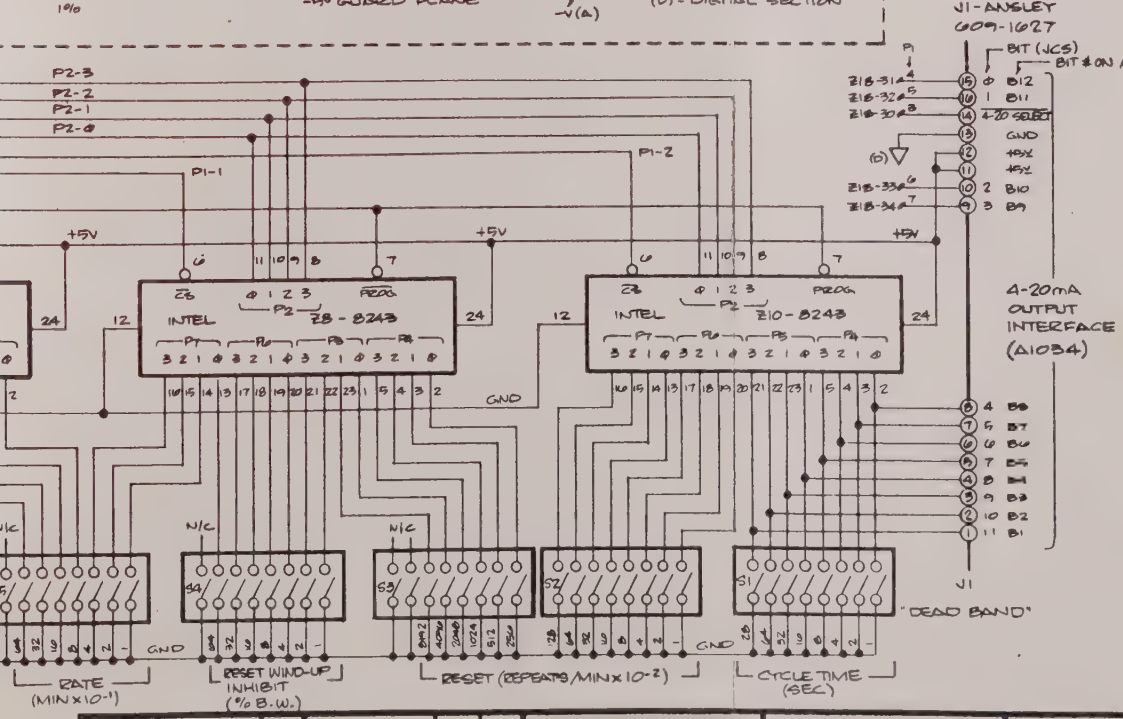
TYP DIPSWITCH
PROP GAIN
MSB
RUN / HOLD
AUTO / MANUAL
REV / DIR (ACTION)
°C/F
Z18 INTEL 8035
Z21 ICL 7109
Z19 22K SIP 4310 R-101-223
Z9 - 8212 "LATCH"
Z14 - TMS2516 "MEM 1"
Z13 - TMS2516 "MEM 2"
Z27 - 8243
Z12 - 4556 "DECODE"
CD4030BE
CD4098BE
TO SHT 2
SHT 2
+5V
GND

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	REVISED PER PROTO EVALUATION: REMOVED SB # JUMPER "C"; NOMENCLATURE CHANGES ON S1 THRU S7; ADDED RA2, 22K; REMOVED TP1 # TP3 FROM ASSY DWG.	5-6-81	
	B	ADDED TURRENTS (140-2089-02-01-00) FOR FAC. SEL. RES. # ENLARGED CLEARANCE AREA (ART SHT 2) FOR COMP. LEADS. C12 # C13 WAS .1μF - REMOVED CR1, R5 # C7 ADDED JUMP "D"	6.30.81	
	B1	CHANGED RESISTOR SELECT CHART	7-8-82	
	B2	REMOVED RES SELECT CHART # RES VALUES	12-9-82	





SB OPEN UP
DWN CLOSED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
	1	A1270		140N	2/5/81	N/C
APPLICATION				EFFECTIVITY		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0°30'
HOLE TOLERANCES
.013 +.004 -.001 THRU .130 .251 +.004 -.001 THRU .500
.130 +.006 -.001 THRU .500 .501 +.008 -.001 THRU .750
MATERIAL 1
FINISH 2
DO NOT SCALE DWG

ENGINEERING ACTIVITY

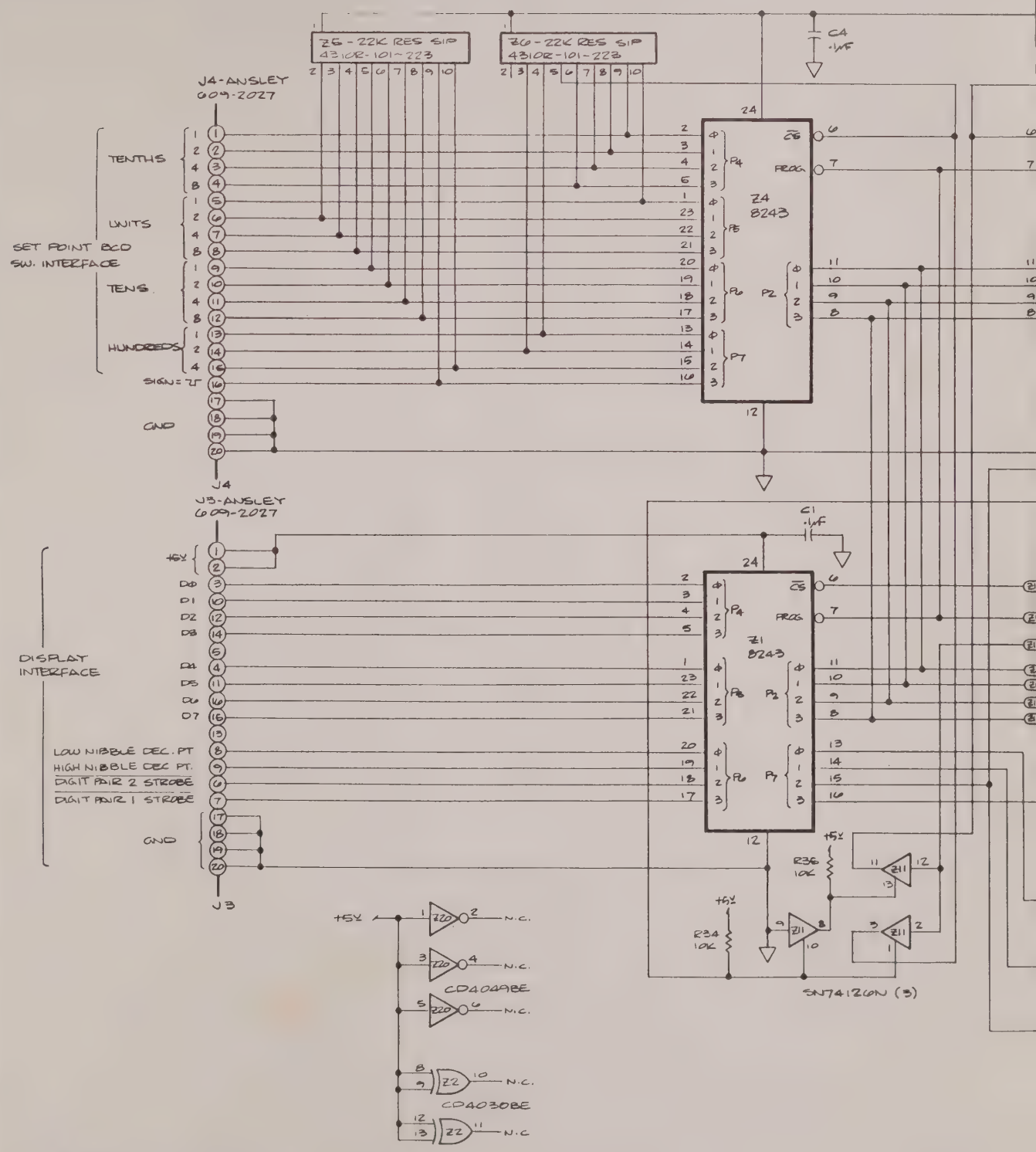
DESIGN	VK SYSTEMS INC
DRAFTED	03 FEB 1981
CHECKED	
APPROV	
RELEASE	

SYSTEMS, INC.
SAN DIEGO (EL CAJON)

TITLE: PRINTED CIRCUIT BD SCH TEMPERATURE CONTROLLER MODEL A1270

SIZE	CODE IDENT	
D		1269- C1

SCALE N.A.
SHEET 1 OF 2



⚠2 FINISH (IF APPLICABLE)

⚠1 MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV
	1	A1270		1 & UP	4/3/81	N/C

APPLICATION | EFFECTIVITY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX ± .03, .XXX ± .010
ANGLES: 0°30'
HOLE TOLERANCES
.013 THRU .128 +.004 -.001
.131 THRU .500 +.006 -.001
.136 THRU .380 +.008 -.001
.501 THRU .750 +.010 -.001
MATERIAL 1
FINISH 2

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC
DRAFTED	" 13 FEB 1981
CHECKED	
APPROV	
RELEASE	

DO NOT SCALE DWG

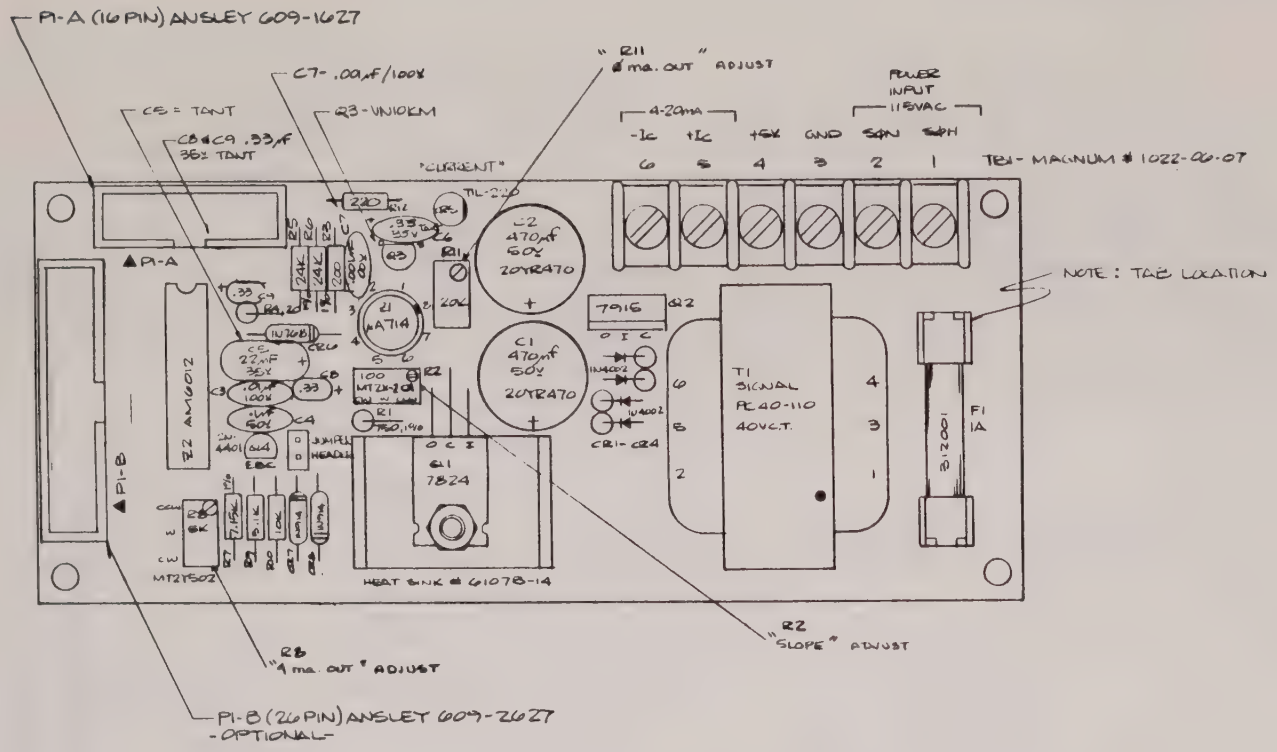
JC SYSTEMS, INC.

TITLE: PRINTED CIRCUIT BD SCH- TEMPERATURE CONTROLLER II MODEL A1270

SIZE	CODE IDENT	
D		1269- C1

SCALE N.A. SHEET 2 OF 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
		SEE SCH C1033		



	1	END ITEM		1 ASSY					
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV			
APPLICATION				EFFECTIVITY					

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0° 30'
HOLE TOLERANCES

.013 THRU .135	+.004 -.000
.136 THRU .250	+.005 -.000
.251 THRU .500	+.006 -.001
.501 THRU .750	+.006 -.001

MATERIAL ⚠
FINISH ⚠

ENGINEERING ACTIVITY	
DESIGN	K SYSTEMS, INC.
DRAFTED	04 OCT 1979
CHECKED	
APPROV	
RELEASE	
DO NOT SCALE DWG	

ENTERPRISES

TITLE: PRINTED CIRCUIT BD ASSY
4-20ma OUTPUT INTERFACE
MODEL A1034

SIZE	CODE IDENT		
C		1034	E
SCALE 2:1		SHEET 1 OF 1	

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	R1 WAS 741; Q4 WAS VN10KM; R7 WAS 5.49K 1%; ADDED: C7 .001 CAP; Z2-19 TO GND, R11 20K POT CR7 & CR8 WAS OPTIONAL; ADDED HEADER JUMPER (2 PIN)	1-31-80	
	B	C6 WAS .1μF; ADDED C8 & C9 .33μF @ 35V TANT C9 IS NO LONGER OPTIONAL	7-1-81	
	D	ADDED P1-A (16 PIN HDR CONN) & P1-B (26 PIN)	9-15-82	
	E	CHANGED 81 - LEAD SPACING	12-16-92	

TB1
F1 1A
SIGNAL PCA0-110
CR1 IN4002
CR2 IN4002
CR3 IN4002
CR4 IN4002
Q1 7824
Q2 7915
+28V
-28V
+24V
-15V
+5V
GND
POWER INPUT 115VAC
SWH
SWN
40V C.T.
C1 470μf 50V
C2 470μf 50V
C8 .33μf (TANT) 35V
C9 .33μf 35V (TANT)
C3 .01μf 100V
C4 .1μf
C5 22μf TANT
R1 750 1%
R2 100
R11 20K
"SLOPE ADJUST"
"4MA CUT ADJUST"
R3 200 1%
C6 .33μF 35V (TANT)
Z1 714
Q3 VN10KM
R12 220
CR5 IN746 (10V)
C7 - .001μF
CR6 TIL220
"CURRENT"
+Ic OUT
-Ic RETURN
4-20mA
ANSLEY 609-2627
P1-B (26 PIN)
NOT USED
P1-A
ANSLEY 609-1627 (16PIN) P1-A
P1-B
(LS BIT) B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 (MS BIT)
R5 24K 1%
R6 24K 1%
R4 20
Z2 Am6012 "D/A CONVERTER"
VREF(-) VREF(+) COMP GND VLC V- V+
LSB B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 MSB
P2 INSTALLED FOR 4-20mA OPERATION
P2 REMOVED FOR 0-10mA OPERATION
Q4 2N4401
R10 10K
R9 5.1K
R7 7.15K 1%
R8 5K
(TRIM ADJUST)
"4mA CUT ADJUST"
CR7 IN914
CR8 IN914
-15V

DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	
		A034		1 & UP		1 C	
APPLICATION				EFFECTIVITY			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS .XX ± .03 .XXX ± .010
ANGLES 0° 30'
HOLE TOLERANCES
.013 THRU .188 +.005 -.001
.188 THRU .500 +.005 -.001
.501 THRU .700 +.006 -.001
.501 THRU .700 +.008 -.001
MATERIAL ⚠1
FINISH ⚠2

ENGINEERING ACTIVITY

DESIGN	JC ENTERPRISES INC
DRAFTED	" 04 OCT 1979
CHECKED	
APPROV	
RELEASE	

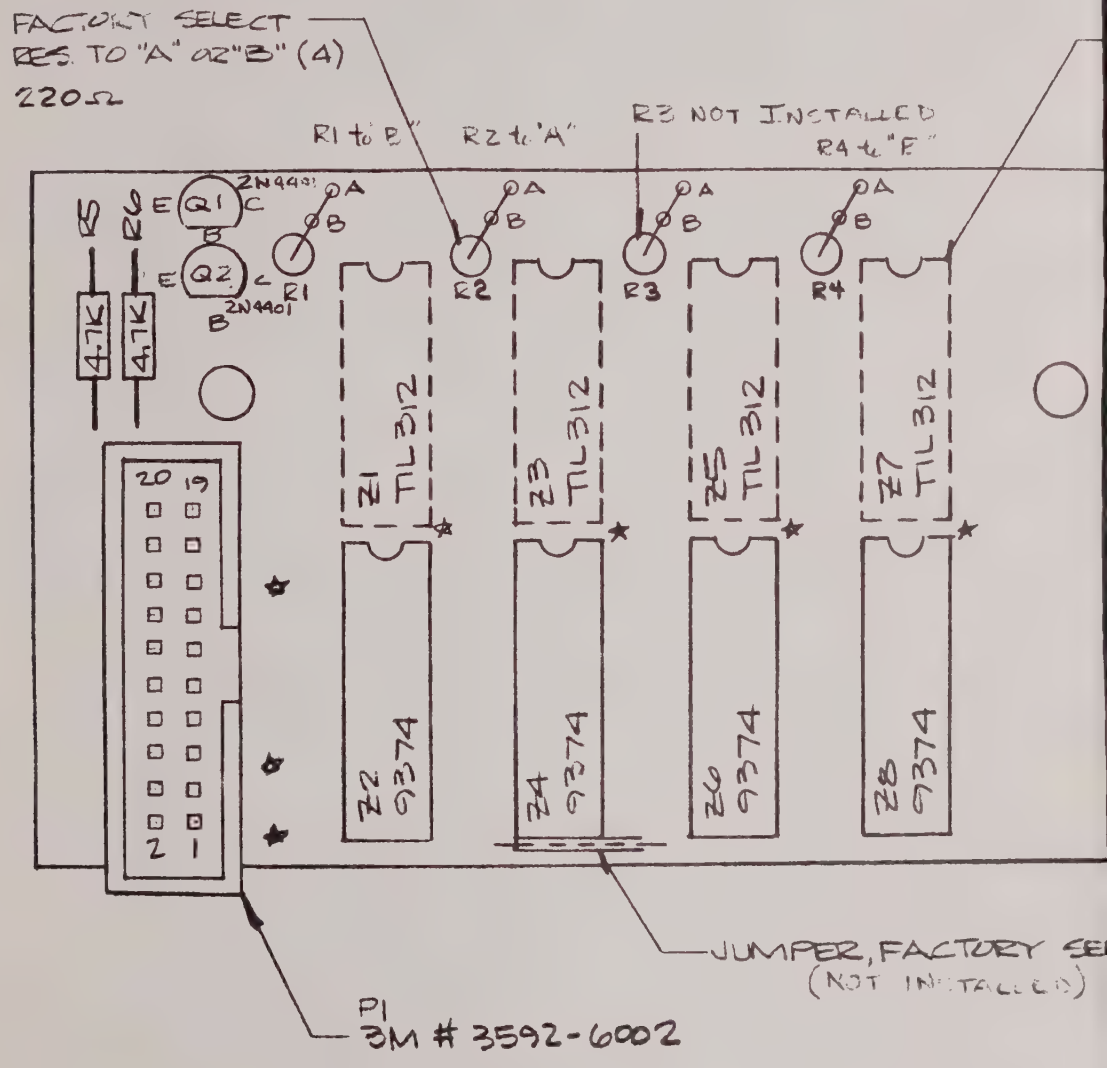
DO NOT SCALE DWG

JC ENTERPRISES SAN DIEGO CALIFORNIA

TITLE: PRINTED CIRCUIT BD SCH - 4-20mA OUTPUT INTERFACE MODEL A1034

SIZE	CODE IDENT		
C		1033	E
SCALE N A		SHEET ___ OF ___	

⚠1 FINISH (IF APPLICABLE)
⚠2 MATL (IF APPLICABLE)
NOTES: UNLESS OTHERWISE SPECIFIED



	1	END ITEM		1 & ON	
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DAT EFF
APPLICATION				EFFECTIVITY	

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD
	A	P1 - WAS ANSLEY XSISTION TYPE 609-2003	7-29-83	

- MOUNT ON FARSIDE (4)

ECT

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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON

DECIMALS	ANGLES
.XX ± .03	0°30'
.XXX ± .010	

HOLE TOLERANCES

.013 THRU .125	+.004 −.001	.251 THRU .500	+.006 −.001
.126 THRU .250	+.005 −.001	.501 THRU .750	+.008 −.001

MATERIAL (1)

FINISH (2)

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC.
DRAFTED	" 29 JUNE 1979
CHECKED	
APPROV	
RELEASE	

DO NO SCALE DWG

JC ENTERPRISES
SAN DIEGO CALIFORNIA

TITLE: PRINTED CIRCUIT BD ASSY - NUMERIC DISPLAY II MODEL A1003

SIZE	CODE IDENT		
B		1003	A

SCALE 2:1

SHEET 1 OF 1

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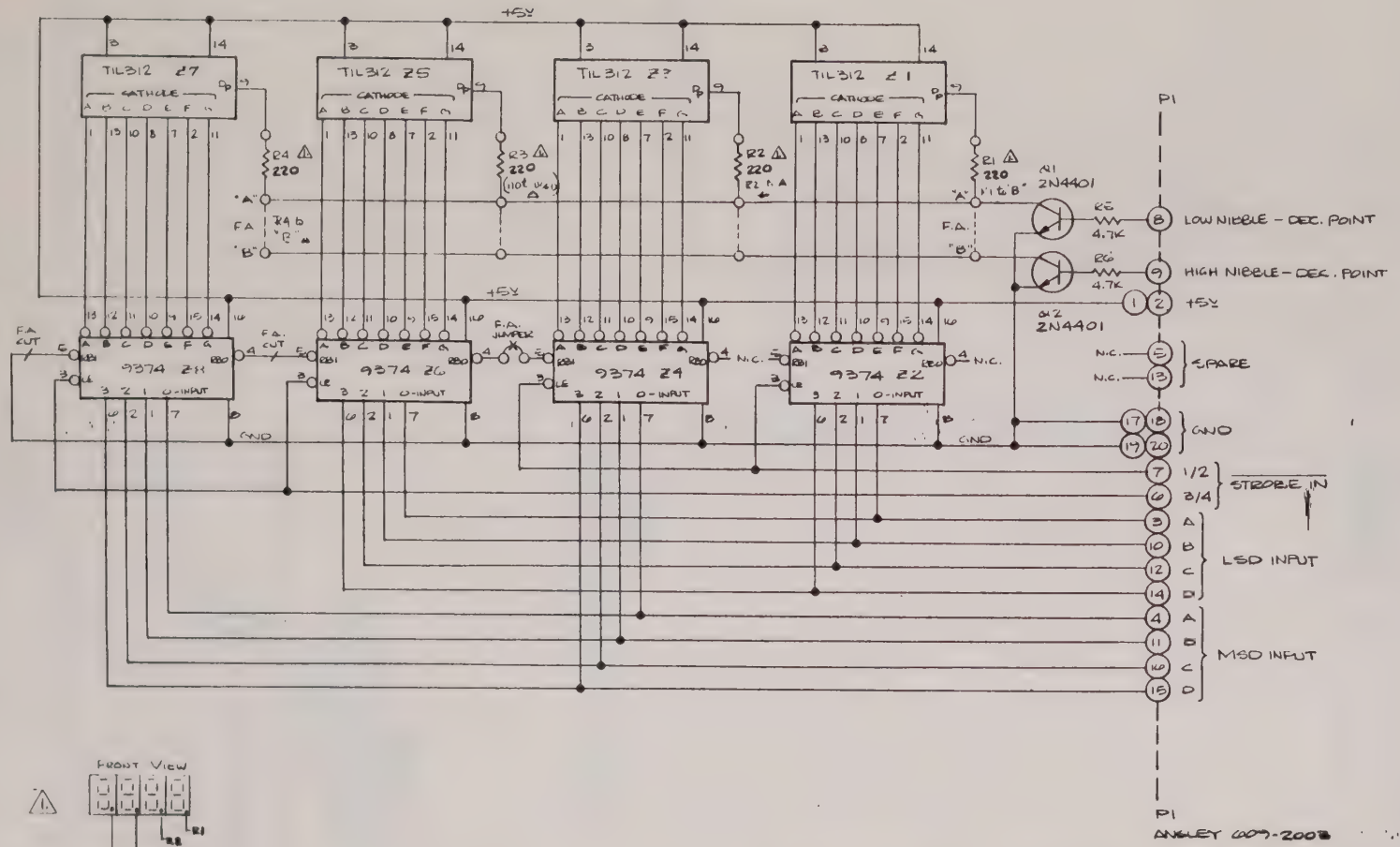
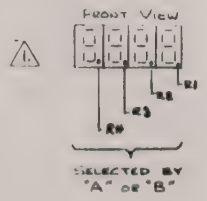
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPD



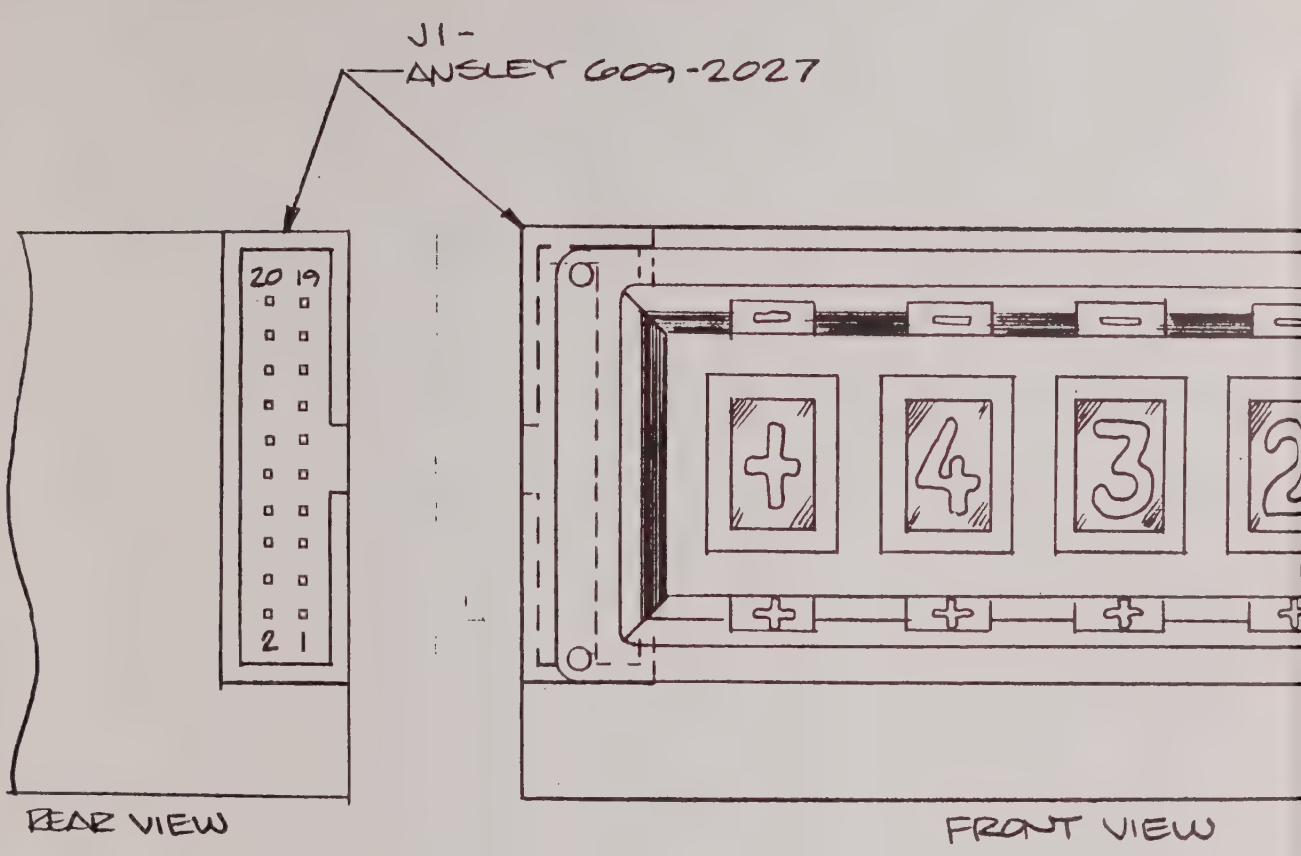


								UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS .XX ± .03 .XXX ± .010 ANGLES 0°30'	ENGINEERING ACTIVITY	ENTERPRISES
								HOLE TOLERANCES .013 THRU .125 +.004 −.001; .131 THRU .500 +.004 −.001; .130 THRU .500 +.005 −.001; .501 THRU .750 +.005 −.001	DESIGN JC SYSTEMS INC.	TITLE: PRINTED CIRCUIT BD SCH — NUMERIC DISPLAY II MODEL A1003
									DRAFTED " 29 JUNE 1979	
									CHECKED	
									APPROV	
	1	A1002		1 d ON		NIC			RELEASE	SIZE C; CODE IDENT; 1002
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DATE EFF	DWG REV	MATERIAL ⚠		DO NOT SCALE DWG	SCALE N.A; SHEET 1 OF 1
APPLICATION				EFFECTIVITY			FINISH ⚠			

⚠ FINISH (IF APPLICABLE)

MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED



⚠ FINISH (IF APPLICABLE)

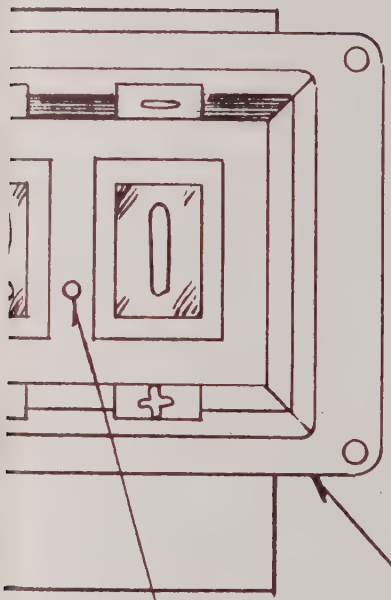
⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

		END ITEM		1 & ON	
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DAT EFF
APPLICATION				EFFECTIVITY	

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPD
	A	J1 WAS ANSLEY 609-2003; ADDED SHT 2 TO ART 960; MADE BD. SMALLER	6-12-81	
	B	CHANGED ART & DRILL SO AS TO CUT SLOTES FOR SWITCH FROM EDGE OF BD.	1-19-82	



DURANT DIGI SWITCH
#49902-407(4) & 49902-404(1)
W/BEZEL, END PLATE # (2)

.046 DIA x .031 DEEP THEN
BACK FILL USING WHITE PAINT

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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS: .XX : .03; .XXX : .010
ANGLES: 0° 30'

HOLE TOLERANCES

.013 THRU .125	+.004 −.001	.251 THRU .500	+.006 −.001
.126 THRU .250	+.005 −.001	.501 THRU .750	+.008 −.001

N/C

DWG REV | MATERIAL △1 | FINISH △2

ENGINEERING ACTIVITY

DESIGN	JCSYSTEMS INC
DRAFTED	19 APRIL 1979
CHECKED	
APPROV	
RELEASE	

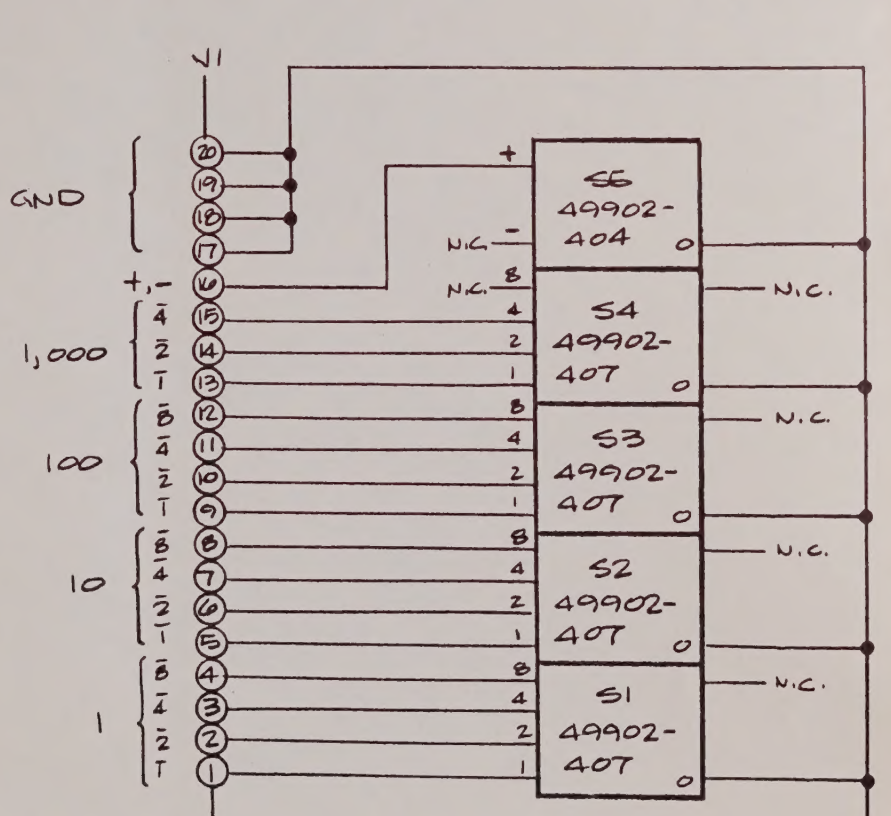
DO NO SCALE DWG

JC ENTERPRISES
SAN DIEGO CALIFORNIA

TITLE: PRINTED CIRCUIT BD ASSY-TEMPERATURE DIGI-SWITCH MODEL A959

SIZE	CODE IDENT		
B		959	B

SCALE 2:1 | SHEET 1 OF 1



	1	A959		1 & UP	
DASH	QTY	NEXT ASSY	USED ON	SERIAL NO.	DAT EF
APPLICATION				EFFECTIVITY	

⚠ FINISH (IF APPLICABLE)

⚠ MATL (IF APPLICABLE)

NOTES: UNLESS OTHERWISE SPECIFIED

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPD
	A	J1 WAS ANSLEY 6009-2008; MADE BD SMALLER & ADDED SHT 2 ART 960	6/12/81	
	B	CHANGED ART & DRILL SO AS TO CUT SLOTES FOR SWITCH IN FROM EDGE OF BD.	1-19-82	

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UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS
.XX ± .03
.XXX ± .010
ANGLES
0°30'

HOLE TOLERANCES

.013 THRU .125	+.004 −.001	.251 THRU .500	+.006 −.001
.126 THRU .250	+.005 −.001	.501 THRU .750	+.008 −.001

N/C

DWG REV

MATERIAL ⚠1

FINISH ⚠2

ENGINEERING ACTIVITY

DESIGN	JC SYSTEMS INC.
DRAFTED	" 19 APRIL 1979
CHECKED	
APPROV	
RELEASE	

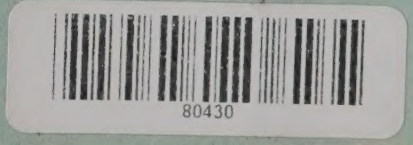
DO NO SCALE DWG

JC ENTERPRISES
SAN DIEGO CALIFORNIA

TITLE: PRINTED CIRCUIT BD SCH-TEMPERATURE DIGI-SWITCH MODEL A959

SIZE	CODE IDENT		
B		958	B

SCALE N.A. SHEET 1 OF 1


80430